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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/627,611

07/28/2003

Hiroshi Watanabe

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08/21/2006

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EXAMINER

KAO, CHIH CHENG G

ART UNIT

PAPER NUMBER

2882

DATE MAILED: 08/21/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

**Office Action Summary**

Application No.

10/627,611

Applicant(s)

WATANABE ET AL.

Examiner

Chih-Cheng Glen Kao

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 08 August 2006.  
2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.  
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 2-9 and 11-20 is/are pending in the application.  
4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.  
5) ☒ Claim(s) 2-8, 11-13 and 19 is/are allowed.  
6) ☒ Claim(s) 9, 17 and 18 is/are rejected.  
7) ☒ Claim(s) 14-16 and 20 is/are objected to.  
8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.  
10) ☒ The drawing(s) filed on 17 November 2005 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).  
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☒ All b) ☐ Some \* c) ☐ None of:  
1. ☒ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- 1) ☒ Notice of References Cited (PTO-892)  
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)  
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_.  
4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date \_\_\_\_\_.  
5) ☐ Notice of Informal Patent Application (PTO-152)  
6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Continued Examination Under 37 CFR 1.114*

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on August 8, 2006, has been entered.

### *Claim Rejections - 35 USC § 103*

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 9, 17, and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Morales (US 6810104) in view of Kobayashi et al. (US 5005075).

3. Regarding claim 9, Morales discloses a method comprising forming an X-ray layer (figs. 13a-16b, #10), forming a first X-ray absorber (fig. 16b, #30' in the same plane of #23) opposite said X-ray layer (fig. 16b, #10), said first X-ray absorber including a plurality of spaced apart first X-ray absorber portions, each first X-ray absorber portion having a first width (fig. 16b, width of #30' in the same plane of #23), and forming a second X-ray absorber (fig. 16b, #30' in

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the plane above #23) on said first X-ray absorber (fig. 16b, #30' in the same plane of #23), said second X-ray absorber comprising a plurality of second X-ray absorber portions spaced from each other, each second X-ray absorber portion (fig. 16b, #30' in the plane above #23) being disposed on a corresponding one of the first X-ray absorber portions (fig. 16b, #30' in the same plane of #23), each second X-ray absorber portion having a second width (fig. 16b, width of #30' in the plane above #23), larger than the first width (fig. 16b, width of #30' in the same plane of #23).

However, Morales fails to disclose an X-ray transmitter.

Kobayashi et al. teaches an X-ray transmitter (col. 1, lines 21-38).

It would have been obvious, to one having ordinary skill in the art at the time the invention was made, to include the method of Morales with the X-ray transmitter of Kobayashi et al., since one would have been motivated to make such a modification to transfer a fine pattern with high precision (col. 1, lines 10-15) and for having a layer with a characteristic strongly withstanding X-ray radiation carried out on exposure and consequently an invariable characteristic against the X-ray radiation (col. 1, lines 32-34) as shown by Kobayashi et al.

4. Regarding claim 17, Morales further discloses wherein at least one of said first and second X-ray absorbers is selected from the group consisting of lithium, beryllium, boron, carbon, sodium, magnesium, aluminum (col. 18, line 60), silicon, phosphorus, sulfur, potassium, calcium, scandium, titanium, vanadium, chromium, manganese, iron, cobalt, nickel, copper, zinc, gallium, germanium, arsenic, selenium, palladium, silver, cadmium, indium, tin, antimony, tellurium, cesium, barium, mixtures of these elements, a carbide including silicon carbide and

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tungsten carbide, a nitride including silicon nitride, aluminum nitride, and chromium nitride, an oxide including silicon oxide and chromium oxide, a fluoride, and an iodide.

5. Regarding claim 18, Morales further discloses wherein at least one of said first and second X-ray absorbers is selected from the group consisting carbon, titanium, vanadium, chromium, manganese, iron, nickel, copper, zinc, gallium, germanium, arsenic, selenium, palladium, silver, cadmium, indium, tin (col. 18, line 60), antimony, and tellurium.

*Allowable Subject Matter*

6. Claims 2-8, 11-13, and 19 are allowed. Claims 14-16 and 20 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The following is a statement of reasons for the indication of allowable subject matter.

7. Regarding claim 7, prior art fails to disclose or fairly suggest a method of fabricating an X-ray mask, including forming a laminated X-ray absorber on a surface of an X-ray transmitter, but not in recesses, wherein said laminated X-ray absorber includes at least two layers having different compositions, wherein phase shift of X-rays transmitted through said X-ray absorber is in a range of  $0.3\pi$  to  $0.6\pi$  and transmittance of the X-rays transmitted through said X-ray absorber is in a range of 30% to 60% for X-rays having an average exposure wavelength longer than 0.3 nm and shorter than 0.7 nm, in combination with all the limitations in the claim. Claims 2-6, 8, and 19 are allowed by virtue of their dependency.

8. Regarding claim 11, prior art fails to disclose or fairly suggest a method of fabricating a semiconductor device, including carrying out an exposure with an X-ray mask having a geometric X-ray phase difference between a phase of X-rays transmitted through an X-ray transmission part of said X-ray mask and a phase of X-rays transmitted through an X-ray absorber of said X-ray mask in a range including  $0.5\pi$  and in proximity to  $0.5\pi$ , wherein a laminated structure includes at least two layers having different compositions, and either a phase shift of the X-rays transmitted through said X-ray absorber is in a range of  $0.3\pi$  to  $0.6\pi$  or the transmittance of the X-rays transmitted through said X-ray absorber is in a range of 30% to 60%, in combination with all the limitations in the claim. Claims 12 and 13 are allowed by virtue of their dependency.

9. Regarding claim 14, prior art fails to disclose or fairly suggest a method of fabricating an X-ray mask, including wherein tungsten is employed as one of first and second absorbers, and diamond is employed as the other of said first and second X-ray absorbers, in combination with all the limitations in the claim.

10. Regarding claim 15, prior art fails to disclose or fairly suggest a method of fabricating an X-ray mask, including forming an etching stopper film, stopping etching when etching a first X-ray absorber on an X-ray transmitter, and forming a second X-ray absorber on said etching stopper film, in combination with all the limitations in the claim.

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11. Regarding claim 16, prior art fails to disclose or fairly suggest a method of fabricating an X-ray mask, including forming an interlayer film as an etching stopper or a hard mask on a first X-ray absorber, and forming a second X-ray absorber on said interlayer film, in combination with all the limitations in the claim.

12. Regarding claim 20, prior art fails to disclose or fairly suggest a method of fabricating an X-ray mask, including wherein a first X-ray absorber consists of a first X-ray absorbing material and a second X-ray absorber consists of a second X-ray absorbing material different from said first X-ray absorbing material, in combination with all the limitations in the claim.

### ***Response to Arguments***

13. Applicant's arguments with respect to claims 9, 17, and 18 have been considered but are moot in view of the new ground(s) of rejection.

### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Chih-Cheng Glen Kao whose telephone number is (571) 272-2492. The examiner can normally be reached on M - F (9 am to 5 pm).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Ed Glick can be reached on (571) 272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.



Chih-Cheng Glen Kao  
Examiner  
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